SWCD Dam Safety Work Group

Developing & Implementing Emergency Action Plans

Presented by: **Ken Turner, P.E.**
Commonwealth of Virginia,
Department of Conservation & Recreation
District Dam Safety Consultant

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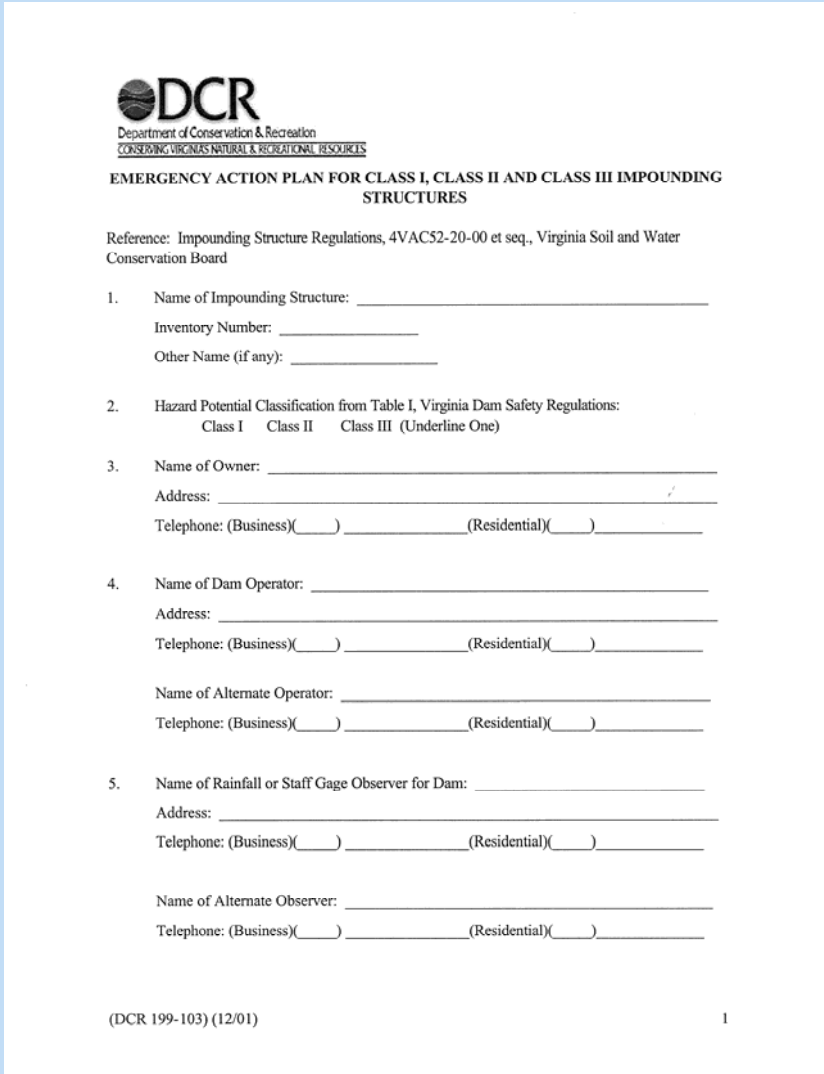
Sample Emergency Action Plan Form

This form and other dam safety related forms can be found on DCR's web page at:

http://www.dcr.virginia.gov



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EMERGENCY ACTION PLAN FOR CLASS I, CLASS II AND CLASS III IMPOUNDING STRUCTURES

Reference: Impounding Structure Regulations, 4VAC52-20-00 et seq., Virginia Soil and Water Conservation Board

1. Name of Impounding Structure: _____
   Inventory Number: _____
   Other Name (if any): _____

2. Hazard Potential Classification from Table I, Virginia Dam Safety Regulations:
   Class I Class II Class III (Underline One)

3. Name of Owner: _____
   Address: _____
   Telephone: (Business)(____) _____(Residential)(____)_____

4. Name of Dam Operator: _____
   Address: _____
   Telephone: (Business)(____) _____(Residential)(____)_____

   Name of Alternate Operator: _____
   Telephone: (Business)(____) _____(Residential)(____)_____

5. Name of Rainfall or Staff Gage Observer for Dam: _____
   Address: _____
   Telephone: (Business)(____) _____(Residential)(____)_____

   Name of Alternate Observer: _____
   Telephone: (Business)(____) _____(Residential)(____)_____

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What causes embankments to fail?

- A. **Erosion** caused by **Overtopping** of the Embankment

  Timberlake Dam in Campbell County, VA 2 Dead, >$1 Million
- B. **Erosion** due to **Piping** through the Embankment

  Grand Teton Dam in Idaho 11 Dead, >$1 Billion
- C. **Problems** that cause the dam to not function as designed.
- D. **External Issues** like **Earthquakes** or **Terrorism** that the dam was not designed to survive.

Notable Dam Failures

Johnstown, PA; 1889
220 Dead
$17 Million in Damages

St. Francis, CA 1928
450+ Dead
1200 Homes & 10 Bridges Destroyed

Buffalo Creek Dam, WV 1972
125 Dead
> $400 Million in Damages

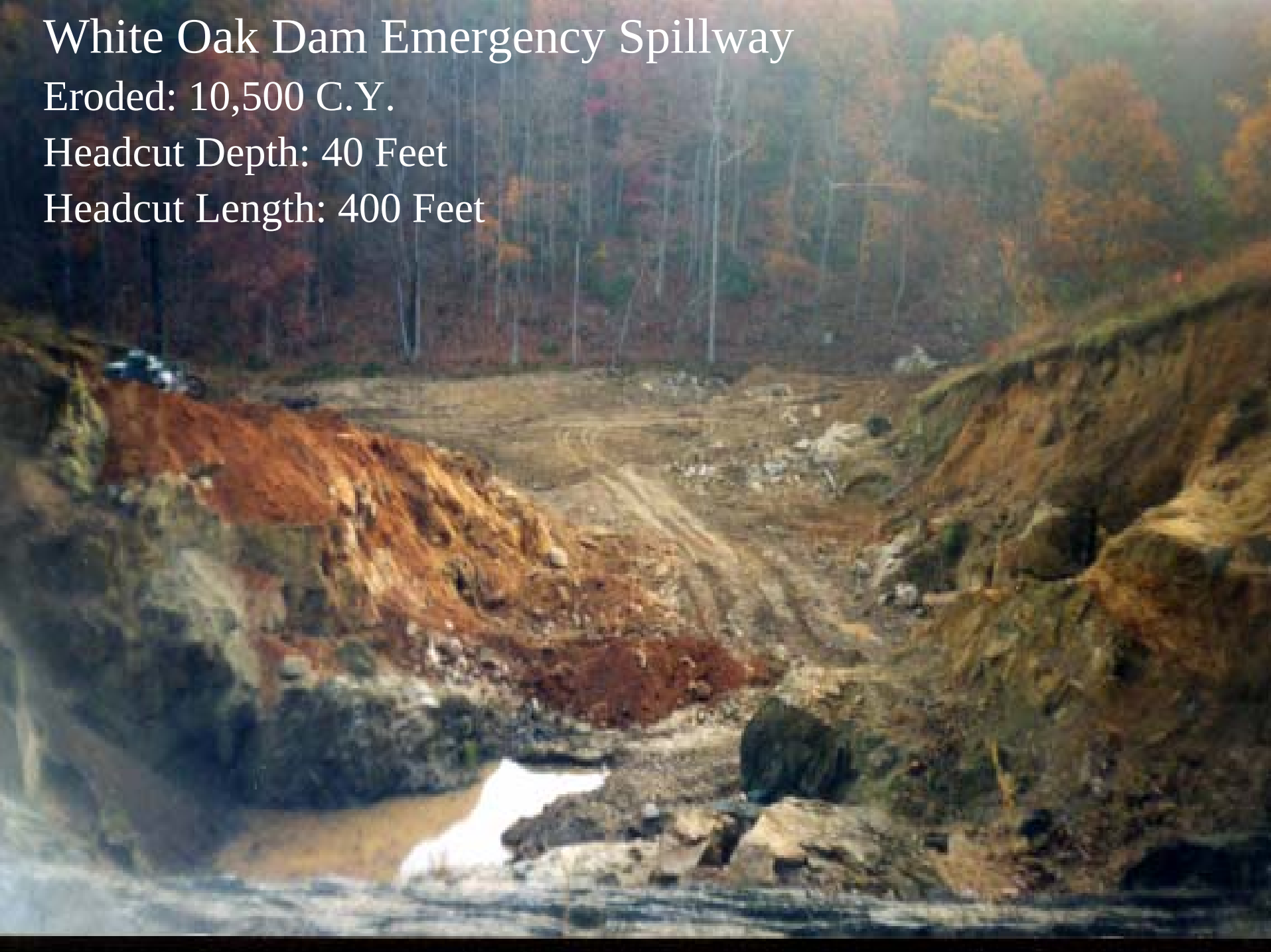
Canyon Lake Dam, SD; 1972
230 Dead
$164 Million in Damages

Teton Dam, ID; 1976
11 Dead
$1 Billion in Damage

Baldwin Hills Dam, CA; 1963
5 Dead
41 Homes Destroyed
986 Homes Damaged
100 Apartment Bldg Damaged

Overtopping Failure in Process – Erosion from Overtopping

Sunny Day Failure – Erosion by Piping


White Oak Dam Emergency Spillway
Eroded: 10,500 C.Y.
Headcut Depth: 40 Feet
Headcut Length: 400 Feet

Today's Emergency Action Plan Program

A. Provide basic information

B. Components of an Emergency Action Plan (EAP)

C. Dam Owner Responsibilities

D. Event Detection

E. Emergency Level Determination

F. Notification & Communication

G. Notification Flow Chart

H. Expected Action

Today's EAP Program (Cont'd)

I. Termination

J. EAP Exercise Programs

K. EAP Maintenance

L. Break Inundation Areas

M. Examples of Damage

N. Appendices

O. Development Review – Nine Step Process

Learning Objectives

Basic Knowledge about:

- Emergency Action Plans (EAP), generally
- The main components of an EAP
- The steps required to develop an EAP
- The steps required to implement an EAP

Definition of an Emergency Action Plan

A formal document that identifies potential emergency conditions at a dam and specifies pre-planned actions to be followed to minimize property damage or loss of life as a result of failure or operations of a dam

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Need For Emergency Action Plan

Regardless of the requirement for a recorded or documented EAP by the State Dam Safety Program, every dam owner is strongly encouraged to develop some type of EAP that can be used to implement an emergency action response in the event of an incident at their dam

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"RUN FOR IT!"
IS NOT AN
ADEQUATE
EMERGENCY
ACTION PLAN.
N.H.
D.E.S.

Components of an Emergency Action Plan

1. Basic Contact Information for all parties involved
2. Basic Contact Information for Those at Risk
3. Basic Information for Infrastructure at Risk
4. Emergency Conditions Identification
5. Thresh Holds That Will Initiate Action

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Components; Continued

6. Frequency of Observations

7. Surveillance & Notifications - Expected Actions

8. Evacuation Procedures – Expected Actions

9. Agreement of Coordination Between Owner/Operator & Local Government

10. Appendices

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Dam Owner EAP Responsibilities

The dam owner is responsible for development, maintenance, and exercise of the EAP.

Technical sections (such as inches of rainfall or depth of flow triggering levels of response & downstream break inundation mapping) will require the services of a registered professional engineer.

Owner Responsibilities (Cont.)

- The dam owner might also elect to have the same consultant assist in preparation of other sections of the EAP such as:
  - Emergency Detection
  - Evaluation
  - Classification of Potential Dam Failure Incidents
  - Preparedness and Preventive Actions

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Owner Responsibilities (Cont.)

- EAP must be developed in coordination with state and local emergency management groups
- EAP must comply with state dam safety program requirements
- EAP must contain all components previously listed, be in writing, & **agreed to by all parties**.

Nine-Step Process

Step 1: Determine downstream inundation areas

Step 2: Prepare downstream inundation maps

Step 3: Identify EAP implementation events

Step 4: Identify emergency action personnel and coordinate with personnel

Step 5: Identify communication systems

Step 6: Develop draft EAP

Step 7: Conduct draft EAP review meeting

Step 8: Finalize and distribute the EAP

Step 9: Conduct *Tabletop Exercise* of the EAP

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Implementation
Step 1 – Event Detection

This step describes the detection of an unusual or emergency event and provides information to assist the dam owner in determining the appropriate emergency level for the event.

The Owner should ask themselves is there something I can do now to mitigate the conditions about to occur.

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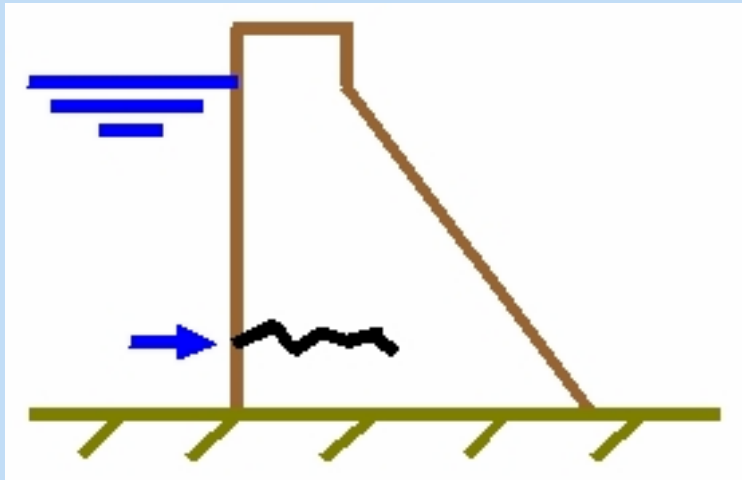
Step 1 - Event Detection (cont'd)

- Forewarning of conditions, which may cause an unusual event or emergency event at the dam. For example, a severe weather or flash flood forecast, hurricane warning. http://nhc.noaa.gov/
- Observations at or near the dam.
- Evaluation of instrumentation data.
- Earthquakes felt or reported in the vicinity of the dam.

Step 2 - Emergency Level Determination

Stage 1; Non-emergency, unusual event, slowly developing

- Declaration of Flood Watch or Warning
- New seepage areas in or near the dam
- New sinkhole in reservoir area or on embankment
- Measurable earthquake felt or reported within 50 miles of dam



Step 2 - Emergency Level Determination

Stage 2; Potential dam failure situation, rapidly developing

- Emergency Spillway flowing with some erosion occurring
- Rapidly enlarging sinkhole
- Cracks in the embankment with cloudy seepage
- Earthquake resulting in visible damage to the dam or appurtenances

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Step 2 - Emergency Level Determination

Stage 3; Urgent - Dam failure is imminent or in process

- Water level rise is within evacuation threshold
- Damage to the dam or appurtenant structures will soon cause an uncontrolled release
- Earthquake resulting in potential uncontrolled release

Step 3 – Notification & Communication

After the emergency level has been determined, the people on the notification flow chart for the appropriate emergency level shall be notified immediately.

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Step 3 – Notification & Communication

Stage I–Non-emergency, Unusual event; Slowly developing

The designated person should call the county/city emergency services coordinator saying we are responding to the dam to see what is going on.

If technical questions are needed then the owner should contact their consulting engineer or the Division of Dam Safety regional engineer.

Step 3 – Notification & Communication

Stage II – Potential Dam Failure; Rapidly Developing

Contact emergency services coordinator and/or 24 hour dispatch center – say that the water level in the spillway has reached the Stage II depth. This will allow them time to mobilize their evacuation team.

Step 3 – Notification & Communication

Stage III – Urgent; Dam Failure is Imminent or in Progress

Contact the emergency services coordinator or 24 hour dispatch center and say the water level has reached the stage III level and they should start the evacuation. Remind them also to contact VDOT to close the roads where the flood water will cross.

Step 3 – Notification & Communication

At Stage II & Stage III Problems can Occur

Issues to Consider:

1. Telephone service & electrical power are usually the first to go during large storms

2. Travel by car is almost always cutoff by high water during these events.

Emergency Notification Flowchart

- All EAPs should contain an EAP Emergency Notification Flowchart that identifies the chain-of-command responsible for notification of emergency response personnel and affected individuals

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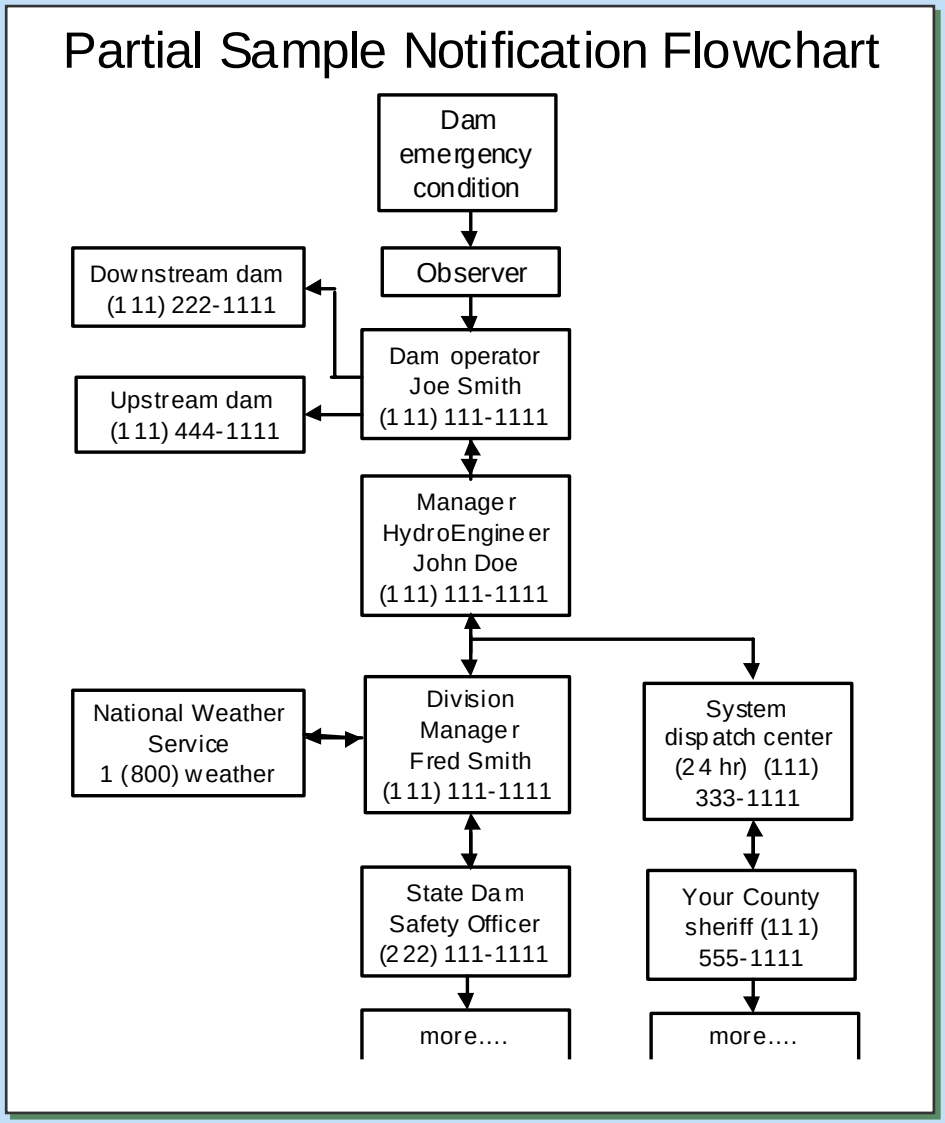
Sample Flow Chart



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Emergency Notification Flowchart Contents

- Individual(s) responsible for notification of local emergency management officials, state dam safety officials and other people involved.
- Specific individual(s) that must be notified of emergency condition should be in the EAP document or on the break inundation map

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Flowchart Contents (Cont.)

- Prioritized listing of individuals and agencies to be notified
- Correct phone numbers and addresses of all individuals, officials, and agencies that must be notified

Step 4 – Expected Actions

- After an emergency level has been determined and the notifications made, the EAP should contain actions to be taken for each emergency level by each person or group involved.
- Possible remedial actions should be included for situations that can be foreseen, if time permits. The intent of these remedial actions is to delay, moderate, or prevent the failure of the dam.

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Step 4 – Expected Actions

- Should include descriptions of the following:
  - Schedule of preventative actions to provide timely response in critical emergency situations
  - Equipment and materials that must be on-site or readily available for use in prevention of a dam failure incident or to reduce the impact of a dam failure incident
  - Identification of equipment operators qualified to institute preventative actions and measures

Step 5 - Termination

- Whenever the EAP has been activated and the emergency is over, the event must be terminated.

The EAP should specify who issues the termination order and how it is handled. Emergency Services Coordinator recommended.

- The staff gauge observer should remain on site until the water level in the emergency spillway starts to recede or the dam breaks.

EAP Exercise Programs

- Purpose
  - Promote coordination of emergency preparedness
  - Demonstrate workability of the EAP
  - Results in improved, more effective EAP

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Definition of EAP Exercise

- An activity designed to promote emergency preparedness; test or evaluate emergency operations, policies, plans, procedures or facilities; train personnel in emergency management duties; and demonstrate operational capability.

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Objectives of EAP Exercises

- Reveal strength and weaknesses in EAP
- Reveal capabilities and deficiencies in resources and information
- Improve coordination
- Clarify roles and responsibilities
- Improve individual performance
- Increase public recognition of EAP

Types of EAP Exercises

- Orientation seminar
- Drill
- Tabletop exercise
- Functional exercise
- Full scale exercise

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Orientation Seminar

- Familiarize participants with:
  - EAP
  - Roles and responsibilities
  - Standard procedures
  - Plans for exercise
- Can involve all stakeholders
- Uses meeting format
- Not an actual test

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EAP Drill

- Lowest level exercise that involves an actual test
- Tests, develops or maintains skill in a single response procedure
- Usually an in-house test
- Part of on going training

Tabletop Exercise

- Higher level exercise than drill
- Involves various levels of personnel
- Informal conference room environment
- Low stress, no time constraints
- Action taken and discussion based on a described emergency situation plus a series of messages to players

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Tabletop Exercise

- Opportunity to discuss EAP and response procedures, and resolve questions throughout exercise
  - Ongoing discussion and evaluation of appropriateness of actions taken and decisions made
  - Permits liberal breaks before new messages are delivered to discuss proper response
- Practice problem-solving for emergency situations
- Practice a coordinated, effective response

EAP Maintenance

- **Review Annually**
- **Revise as needed**
- **Periodically Test**
- **Maintain Records of revision dates and distribution list**

Break Inundation Mapping in EAP

- EAP should include downstream dam failure inundation mapping
- Mapping must be performed by a qualified professional engineer
- Mapping must be presented on a reasonable scale map that can be easily read and interpreted under potentially stressful conditions

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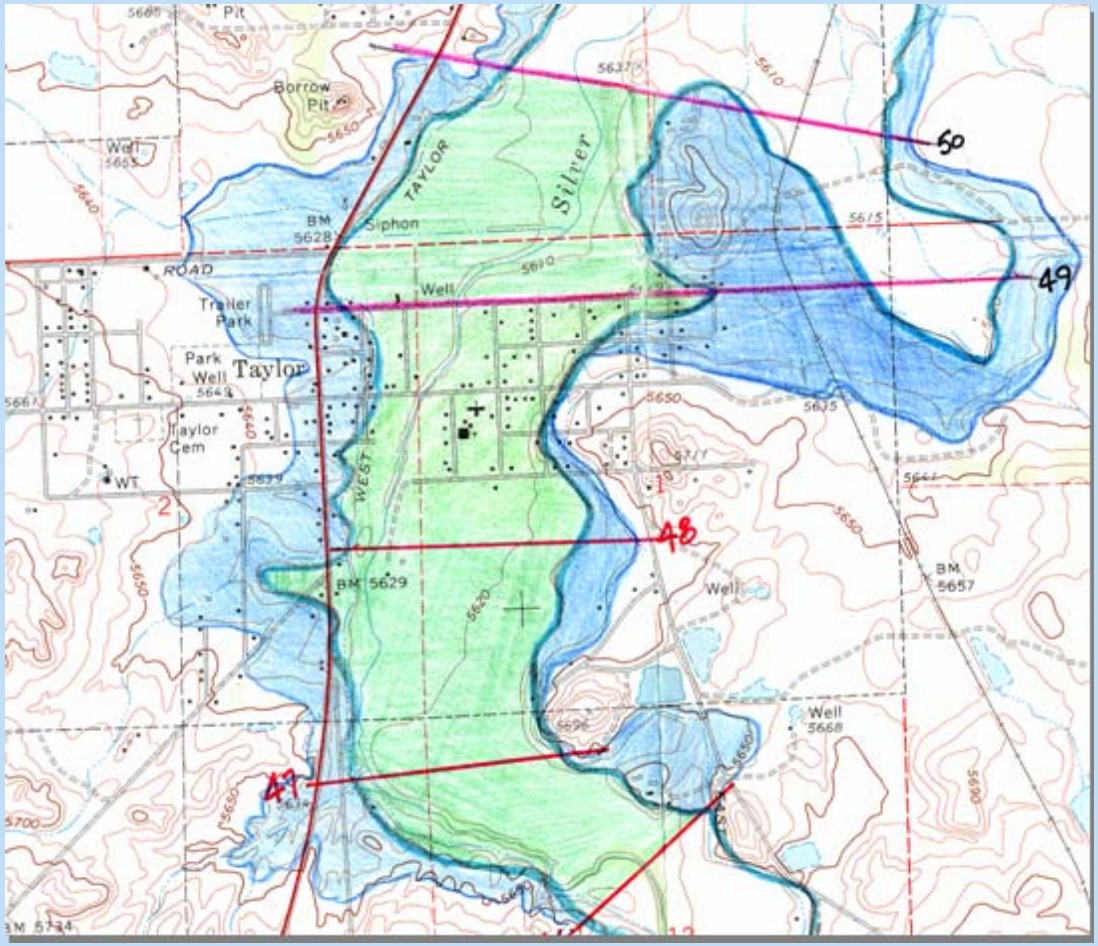
Break Inundation Mapping (Cont.)

- Mapping should deliniate potential flooded areas during SDF discharge and dam failure conditions concurrent with the SDF and the Sunny Day failure, plus any additional events as defined by the State Dam Safety Office.

- Mapping facilitates timely prioritization of potential flooding notification and evacuation

- Travel times of the flood wave should be noted as should names and contact information for people and business in harms way.

Downstream Flooding Resulting from a Dam Break



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Downstream Flood Damage from Dam Failure

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Downstream Flood Damage from Dam Failure

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Documentation and Appendices in the EAP

- Attached documents should substantiate development of the EAP
- Attached documents should provide specific instructions for, and frequency of, maintenance of the EAP

Documentation and Appendices in the EAP (Cont.)

- Documentation should include all maps, calculations, computer printouts for documentation of the downstream flood routing and inundation mapping process. Alternately, the calculations & computer printouts could be submitted to the State Dam Safety Office, but are not necessary in the EAP.

Review Development of EAP: Nine-Step Process Overview

- The Nine-Step Process for development of EAP requires the cooperative effort between:
  - Dam owner
  - Dam owner's engineer
  - Emergency action agency personnel
  - Members of the community

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Questions?

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The End